HORIZON POWER SYSTEMS

July 8, 2014

TO: Docket No. G-01551A-13-0170
Combined Heat and Power (CHP) Microturbine Data for Staff Analysis

RE: For Commission Review

ORIGINAL

Microturbine Based CHP Project Data
for Arizona Corporation Commission (ACC) Cost-Effectiveness Analysis

Thank you for the opportunity to provide the data below, so that the ACC Commission Staff can complete a cost-effectiveness analysis on microturbine combined heat and power (CHP) systems, so that these microturbine CHP systems can be considered and analyzed to determine whether Staff will recommend microturbine CHP systems as a cost-effective addition to the Southwest Gas energy efficiency program.

- **Project Summary Data:**
  - Project location: Phoenix metropolitan area
  - Application: Healthcare (hospital)
  - System description: 65kW microturbine prime mover/generator with integrated air to water heat exchanger (see attached specification cut sheet)
  - Power use: Provide facility base load power 18/7/365, avoiding high peak demand charges ($/kW) and avoiding base load kWh. When power demand exceeds microturbine/generator output, then the utility provides the remainder of the power needs. System runs in parallel to the electric utility, connected on the customer side of the meter, & will not export power to the utility grid.
  - Thermal use: Provide facility base load space heating hot water 18/7/365, offsetting or avoiding using the existing hot water boiler. When heating demand exceeds CHP system output, existing boiler provide the remainder of the heating hot water.
  - CHP system runtime hours/year: 6570 hours/year.
  - Total CHP system efficiency (Electrical + Thermal): 75.2%
  - Electric utility: Arizona Public Service (APS)
  - Natural Gas utility: Southwest Gas Corporation (SWG)

- **Arizona Corporation Commission (ACC) Staff Requested Data:**
  - Installation Year: March 2014 – February 2015
  - Base Year: March 2013 – February 2014
  - Lifespan: 10 years/80,000 hours
  - Actual Cost of Microturbine CHP: $122,510.00

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- Actual Cost of Alternative: Unknown for alternative CHP. However, the real alternative system would be the participant deciding to replace the old boiler with a new boiler system if they decide not to install the microturbine CHP. By installing microturbine CHP, the avoided cost of the new boiler system would be $40,000.00
- Installation Cost: $45,000.00
- Incremental Maintenance Cost: $0.018/kWh, includes turbine overhaul after 5 years. Includes scheduled and unscheduled maintenance for 9 years.
- kWh Saved: 365,762 kWh/year (base year kWh usage:1,802,880 kWh)
- Therms Saved: 23,467 therms/year (base year therms used: 52,041 therms)
- kW Saved: Peak demand (kW) reduced by 56kW on average each month, taking temperature derate into consideration. Average annual kW saved: 672kW/year (56kW/month x 12 months).

Please let me know if you have any questions or need more information about microturbine CHP systems. Thank you.

Sincerely,

Vito J. Coletto

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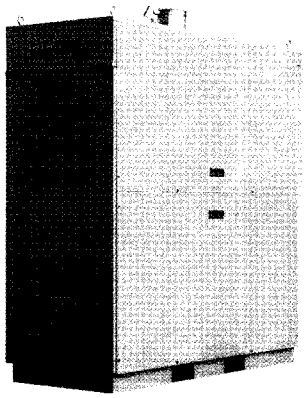
C65 & C65 ICHP MicroTurbine Natural Gas

Achieve ultra-low emissions and reliable electrical/thermal generation from natural gas.

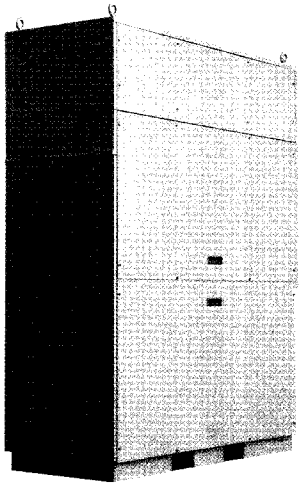
- Ultra-low emissions
- One moving part – minimal maintenance and downtime
- Patented air bearing – no lubricating oil or coolant
- 5 and 9 year Factory Protection Plans available
- Remote monitoring and diagnostic capabilities
- Integrated utility synchronization and protection[1]
- Small, modular design allows for easy, low-cost installation
- Reliable – tens of millions of run hours and counting



C65 MicroTurbine

Electrical Performance[2]

Electrical Power Output	65kW
Voltage	400–480 VAC
Electrical Service	3-Phase, 4 wire
Frequency	50/60 Hz, grid connect operation
	10–60 Hz, stand alone operation
Maximum Output Current	100A, grid connect operation
	100A, stand alone operation[3]
Electrical Efficiency LHV	29%



C65 ICHP MicroTurbine

Fuel/Engine Characteristics[2]

Natural Gas HHV	30.7–47.5 MJ/m³ (825–1,275 BTU/scf)
Inlet Pressure[4]	517–552 kPa gauge (75–80 psig)
Fuel Flow HHV	888 MJ/hr (842,000 BTU/hr)
Net Heat Rate LHV	12.4 MJ/kWh (11,800 BTU/kWh)

Exhaust Characteristics[2]

NOx Emissions at 15% O_2[5]	< 9 ppmvd (19 mg/m³)
NOx / Electrical Output[5]	0.16 g/bhp-hr (0.46 lb/MWhe)
Exhaust Gas Flow	0.49 kg/s (1.08 lbm/s)
Exhaust Gas Temperature	309°C (588°F)

Reliable power when and where you need it. Clean and simple.

C65 ICHP Heat Recovery[6]		
Integrated Heat Recovery Module Type	Copper Core	Stainless Steel Core
Hot Water Heat Recovery	112kW (0.38 MMBTU/hr)	70kW (0.24 MMBTU/hr)

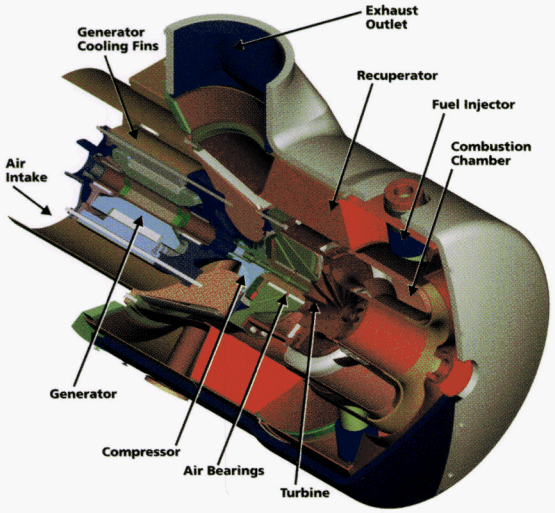
Dimensions & Weight[7]	C65	C65 ICHP
Width x Depth[8] x Height[9]	0.76 x 2.0 x 1.9 m (30 x 77 x 75 in)	0.76 x 2.2 x 2.36 m (30 x 87 x 93 in)
Weight – Grid Connect Model	758 kg (1,671 lb)	1000 kg (2,200 lb)
Weight – Dual Mode Model	1121 kg (2,471 lb)	1364 kg (3,000 lb)

Minimum Clearance Requirements[10]	C65	C65 ICHP
Horizontal Clearance		
Left & Right	0.76 m (30 in)	0.76 m (30 in)
Front[11]	1.65 m (65 in)	1.65 m (65 in)
Rear	0.91 m (36 in)	0.76 m (30 in)

Sound Levels	C65	C65 ICHP
Acoustic Emissions at Full Load Power[12]		
Nominal at 10 m (33 ft)	70 dBA	65 dBA

Certifications

- Certified to UL 2200 and UL 1741 for natural gas operation (UL files AU2687, E209370)
- Complies with IEEE 1547 and meets statewide utility interconnection requirements for California Rule 21 and the New York State Public Service Commission
- Materials Equipment Acceptance (MEA) approval for New York City
- Models available with optional equipment for CE Marking



(1) Some utilities may require additional equipment for grid interconnectivity
(2) Nominal full power performance at ISO conditions: 59°F, 14.696 psia, 60% RH
(3) With linear load
(4) Inlet pressure for standard natural gas at 39.4 MJ/Nm³ (1,000 BUT/scf) (HHV)
(5) Exhaust emissions for standard natural gas at 39.4 MJ/Nm³ (1,000 BTU/scf) (HHV)
(6) Heat recovery for water inlet temperature of 60°C (140°F) and flow rate of 2.5 l/s (40 GPM)
(7) Approximate dimensions and weights
(8) Depth includes 10 inch extension for the heat recovery module rain hood on ICHP versions
(9) Height dimensions are to the roof line. Exhaust outlet extends at least 7 inches above the roof line
(10) Clearance requirements may increase due to local code considerations
(11) Dual Mode MicroTurbine configuration for Battery Removal clearance
(12) The optional acoustic inlet hood kit can reduce acoustic emissions at the front of the MicroTurbine by up to 5 dBA
Specifications are not warranted and are subject to change without notice.

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